



NASA STTR 2009 Phase I Solicitation

T5 Modeling and Simulation

This topic addresses the ability to measure the predictive capability of integrated spacecraft system models. Future spacecraft mission concepts are being considered that will be difficult or impossible to fully test on the ground. Such mission concepts may include large space telescopes, planet-finding coronagraphs, large microwave sensors for Earth science, and long duration robotic planetary missions, as examples. It is expected that models and simulations will play a central role in the flight qualification of these systems. Doing so will require substantial advancement in modeling and simulation technology.

Subtopics

T5.01 Quantification of Margins and Uncertainties in Integrated Spacecraft System Models

Lead Center: JPL

This subtopic is focused on modeling and simulation technologies for the quantification of margins and uncertainties (QMU) in integrated spacecraft system models. The goal is to develop generic capabilities in QMU either from analysis or from test. The outcomes of the research projects selected under this subtopic may include software packages, benchmark databases, or test methods that support QMU of complex, integrated models.

Possible areas of interest include:

- Reduced order modeling (ROM) for QMU of large scale simulations;
- Methods for efficient QMU for models that couple multiple, large scale commercial or proprietary simulation codes;
- Methods for the roll-up of lower level benchmark or component level tests to subsystem and system uncertainties;

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- Methods for early life cycle (simple) system models that evolve into complex, coupled system models;
 - Development of "open source" databases with unit tests or benchmark tests that support model verification and validation for integrated models;
 - Effective methods for treating epistemic uncertainty in large scale simulations;
 - User interfaces for preparation and execution of large scale QMU analyses, on either commercial or proprietary codes;
 - Methods for inverse statistical modeling or inverse epistemic modeling from test data;
 - Methods for extrapolation of margins and uncertainties outside the domain of model validation tests.

Projects selected under this subtopic should address at least one of the above areas of interest. Multiple-area proposals are encouraged. Proposers should consider:

- Scalability to problems with hundreds or thousands of uncertain parameters;
- Competition against traditional, sampling based methods (e.g., Monte Carlo);
- Application of the methods or techniques throughout the project life cycle, from concept development to flight operations.